ASKAP Update, September 2020

In this issue, we report the resumption of telescope operations, outcomes from the community workshop to plan Pilot Surveys Phase II and an impending upgrade for the ASKAP ingest cluster at Pawsey.

Telescope operations resume

Earlier this month, contractors visited the MRO to recharge the central building fire suppression system after the event reported in the previous issue. This work is now complete, and we have once again powered up the digital systems, computing servers and auxiliary equipment in the central building.

ASKAP came back online swiftly, with only a few hardware components requiring attention from site staff. With the telescope operational, we have resumed consolidation activities designed to improve key systems in advance of Pilot Surveys Phase II.

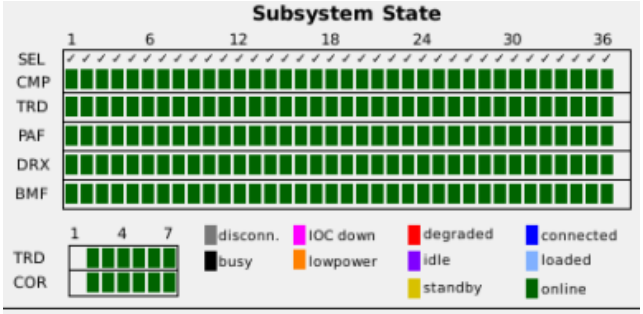

Figure 1: All ASKAP subsystems online! Image courtesy of James Hannah.

Telescope consolidation progress

Engineering teams have been working to address several issues arising from previous tests and Pilot Surveys Phase I data quality analysis. Since resuming operations this month, we have identified and fixed an issue with the coarse filter-bank in the digital receiver. This issue had been introducing strong oscillations into the spectra of individual outputs, contaminating a few beams on a few antennas every time the system was reset. Solving this issue will improve data quality and reduce operational overhead when updating beamformer weights.

We have also released an update to the science data processing pipeline that enables easier re-processing of archived data for which the original measurement set is no longer available. This will allow earlier archiving or deletion of raw data (once intermediate processing products exist) at reduced risk, which should improve the efficiency of our disk management procedures.

Pilot Survey community workshop

Towards the end of August, we ran a community workshop for representatives of the ASKAP survey science teams. This workshop was designed to share the latest thinking on strategies for full surveys and plan the second phase of pilot surveys, with a view to improving our overall observing efficiency through commensal modes.

Discussion confirmed that the optimal survey strategies for each team have diverged since the initial planning stages a decade ago. The total amount of time required to complete each team's observing plans independently is now about a decade at 100% efficiency. Although we expect to operate ASKAP for as long as it remains viable and productive, we would like to determine ways to shrink the timeline for survey completion while exploring the flexibility of the initial 5-year period.

Opportunities for commensality

Two teams that expect to be fully commensal are EMU (an all-sky continuum survey) and POSSUM (an all-sky polarisation survey). The optimal combined strategy for these teams involves using ASKAP band 1, between roughly 800-1100 MHz. This is expected to yield higher source counts than observations in band 2 (1100-1400 MHz) and avoids the worst of the global navigation satellite system interference bands. Combining EMU and POSSUM requires assessing the trade-off between field of view and off-axis polarisation leakage, which should be possible prior to the beginning of Pilot Surveys Phase II using a combination of existing data and new tests.

We will be holding an external review of the survey science plans prior to commencing full survey operations, to provide input on relative priority and time assignment. This review will take place mid-2021, ideally after data from Pilot Survey Phase II has been made available.

Pilot Surveys Phase II

Although many of the survey science teams have viable data from Pilot Survey Phase I, several outstanding issues have been identified, including the need to improve support for wider beamforming frequency intervals, fine-tune continuum subtraction, and investigate loss of phase coherence in some of the data taken with the highest available frequency resolution in 32x zoom mode.

Pilot Surveys Phase II will focus on testing a wide range of observing strategy options. During the workshop, all survey science teams were asked to consider what additional knowledge would be useful for planning the full surveys. Many interesting ideas emerged, including the possible use of 2x zoom mode to provide commensality between GASKAP and WALLABY, testing weekly cadence and short integration times for transient searching, and testing the viability of deep integrations over 100+ hours of combined integration on the same field.

We will be contacting survey science team representatives to discuss and refine plans for Pilot Surveys Phase II over the next few weeks.

ASKAP ingest cluster refresh

The Pawsey supercomputing centre is conducting a staged hardware refresh, with delivery of new supercomputers expected in 2021. As part of this process, the ASKAP ingest cluster will be upgraded in October this year. Pawsey announced this upgrade, along with provision of a new Graphics Processing Unit cluster for the Murchison Widefield Array, in a press release on the 31st of August.

The ingest cluster is the destination for data packets from the observatory, containing complex visibilities produced by ASKAP's on-site correlator. A dedicated network link from the observatory to the Pawsey centre currently supports up to 2.4 GB/s of data, with normal operations using roughly half of this capacity. The ingest cluster collects the raw data and assembles it into a formatted directory hierarchy on disk, after matching each cycle with appropriate metadata from the telescope control system. Due to the high data rate, this process runs on multiple cores across several machines and requires a reliable, high-speed filesystem on which to cache its output. The new ingest cluster should be more powerful than the previous hardware with twice the memory bandwidth, providing better headroom. The cluster will also feature a high-speed solid-state storage array, which should better insulate data ingest from image processing load.

The new hardware is being installed this month and will likely be commissioned in October. This may require a week or more of down-time while the network is re-routed, and the new system put through its paces.

Experimental observations of the Moon

A recent technical feasibility assessment exercise in which ASKAP was used to observe the Moon produced an interesting image dubbed the Lunar Soap Bubble. The image (shown in Figure 2 below) shows polarised intensity with colour representing the orientation of the polarisation vector. Due to difficulties tracking a non-sidereal source, short integrations were observed and stacked to form an image. Smooth tracking of solar system objects will be implemented in a future release of the ASKAP control system, so experiments such as this may provide an interesting addition to the large-scale survey science projects!

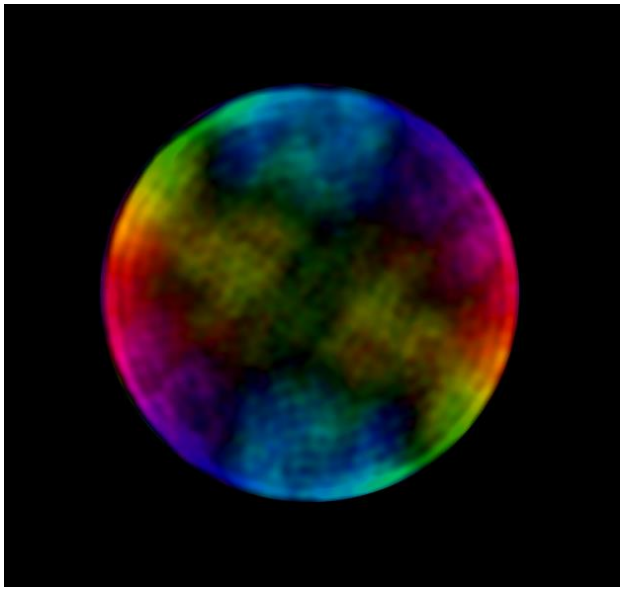

Figure 2: Polarised emission across the Lunar surface, observed in several short ASKAP integrations. Colour is used to indicate the orientation of the polarisation vector. Image courtesy of Emil Lenc, observations by Vanessa Moss.

CONTACT US

t 1300 363 400
+61 3 9545 2176
e csiroenquiries@csiro.au
w www.csiro.au

FOR FURTHER INFORMATION

CSIRO Astronomy and Space Science
Aidan Hotan
t +61 8 6436 8543
e aidan.hotan@csiro.au
w www.csiro.au/askap